

Applicant: Pasi Ahonen, et al.
Application No.: 10/009,095
Art Unit: 1731

Claim Listing

1-33. (cancelled)

34. (currently amended) An air impingement arrangement apparatus for compensating for the curling tendency of a paper or board web which is being treated treated; ~~which air impingement arrangement is disposed in connection with on~~ a paper or board making ~~process or with a~~ or related finishing process machine, said machine having at least one dryer unit which comprises at least one downwardly open single-wire draw group, and being configured to perform in or after the dryer unit, or both in and after the dryer unit, an operation selected from the group consisting of reeling, calendering, intermediate calendering, coating, and additional drying on the web; the apparatus comprising:

at least one air impingement hood positionable to extend and extends substantially across the entire width of the web running in the vicinity thereof and forms to define a contact-free web treatment zone, in which paper, board and/or finishing process the web is dried in at least one dryer unit which comprises at least one downwardly open single-wire draw group, and in which paper, board and/or finishing process, in or after the dryer unit, or both in and after the dryer unit, the web is subjected to an operation selected from the group consisting of reeling, calendering, intermediate calendering, coating, and additional drying; and

wherein the at least one air impingement hood is connected to a source of hot air and a source of cold air, the at least one air impingement hood being configured to produce[[d]] in the web treatment zone by the air impingement arrangement and in a direction directed at the web includes; one following after the other, at least one hot blowing with air from the source of hot air onto the web and at least one cold blowing with air from the source of cold air onto the web.

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35. (currently amended) The air impingement apparatus arrangement of claim 34, wherein moisture condenses and/or is absorbed into the web in cold air blowing, such that the curl behaviour of the web changes to the range of structural, reversible, curl behaviour.

36. (currently amended) The air impingement apparatus arrangement of claim 34, wherein the air impingement in the web treatment zone of the web is applied to a free surface of the web.

37. (currently amended) The air impingement apparatus arrangement of claim 34, wherein the air impingement in the web treatment zone takes place through a drying wire located on the web.

38. (currently amended) The air impingement apparatus arrangement of claim 34 wherein the air impingement arrangement includes at least one hood placed on top of a drying cylinder, a suction roll, an air impingement roll or a cooling cylinder.

39. (currently amended) The air impingement apparatus arrangement of claim 38, wherein the air impingement arrangement is in connection with the last drying cylinder, suction roll, air impingement roll or cooling cylinder of the dryer unit, and that the air impingement arrangement comprises a bipartite hood which is divided by a partition wall into two sections, in which connection, in a machine direction, the web is first subjected to a blowing with hot air from a hot blowing part of the bipartite hood and after that to a blowing with cold air from a cold blowing part of the bipartite hood.

40. (currently amended) The air impingement apparatus arrangement of claim 39, wherein the air treatment zone of the web comprises a first and a second area which are defined by the bipartite hood at said hood and which extend across the width of the web.

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41. (currently amended) The air impingement apparatus arrangement of claim 38, wherein the at least one air impingement ~~arrangement~~ hood comprises two successive and separate hoods placed on top of two successive drying cylinders, suction rolls, air impingement rolls or cooling cylinders, the first of the hoods being a hot blowing part blowing hot air and the latter of the hoods being a cold blowing part blowing cold air.

42. (currently amended) The air impingement apparatus arrangement of claim 41, wherein the air treatment zone of the web treatment zone is bipartite and comprises separately a first area which extends across the width of the web and is located at the hot blowing part placed first in a machine direction, and a second area which extends across the width of the web and is located at the cold blowing part placed after that in a machine direction.

43. (currently amended) The air impingement apparatus arrangement of claim 41, wherein the hood located first in a machine direction is in connection with [[the]] a second last drying cylinder, suction roll, air impingement roll or cooling cylinder, and that the hood located after that in a machine direction is in connection with a last drying cylinder, suction roll, air impingement roll or cooling cylinder.

44. (currently amended) The air impingement apparatus arrangement of claim 38, wherein the ~~air impingement arrangement comprises a hood~~ has which is arranged in ~~connection with a drying cylinder, suction roll, air impingement roll or cooling cylinder and~~ which is a hot blowing part blowing hot air against the web, and a blow box or an airborne drying unit which extends across the web and which is a cold blowing part blowing cold air against the web.

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45. (currently amended) The air impingement apparatus arrangement of claim 44, wherein the web ~~[[air]]~~ treatment zone ~~of the web~~ is bipartite and comprises separately a first area which extends across the width of the web and is located at the hood blowing hot air, and a second area which extends across the width of the web and is located at a blow box or an airborne drying unit blowing cold air.

46. (currently amended) The air impingement apparatus arrangement of claim 44, wherein the ~~air impingement arrangement~~ at least one hood is in connection with a last drying cylinder, suction roll, air impingement roll or cooling cylinder of the dryer unit.

47. (currently amended) The air impingement apparatus arrangement of claim 34, wherein in order to cool the web further before it is processed further, a cooling cylinder is additionally arranged to cool the web ~~in the air treatment zone~~ or after it.

48. (currently amended) The air impingement apparatus arrangement of claim 34, wherein the temperature of air of the cold blowing ~~[[part]]~~ is below 50 °C.

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49. (currently amended) A method for air impingement in order to compensate for the curling tendency of a paper or board web treated in connection with a paper or board process or with a related finishing process, comprising the steps of ; in which air impingement method a contact-free web treatment zone is formed, which treatment zone is extended to cover substantially the entire width of the web; in which paper, board and/or finishing process drying the web is dried in at least one dryer unit unit, which comprises having one or more downwardly open single-wire draw groups; ; and in which paper, board and/or finishing process; in the dryer unit, or after the dryer unit, or in and after the dryer unit, the web is subjected subjecting the web to at least one operation which is selected from the group consisting of reeling, calendering, intermediate calendering, coating, and additional drying; and ; wherein, in at least one web treatment zone, the web is subjected subjecting the web to impingement blowing with air in a contact-free web treatment zone which covers substantially the entire width of the web, in which connection wherein in said zone the web is first subjected to at least one hot air blowing and after that to at least one cold air blowing.

50. (previously presented) The air impingement method of claim 49, wherein moisture is condensed and/or absorbed into the web by said cold air blowing, whereby the curl behaviour of the web is changed to the range of structural, reversible, curl behaviour.

51. (currently amended) The air impingement method of claim 49, wherein the step of subjecting the web to air impingement in the web treatment zone comprises the step of directing air is directed directly at a free surface of the web.

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52. (currently amended) The air impingement method of claim 49, wherein the step of subjecting the web to air impingement further comprises directing cold air blowing is directed at the web from above the web through a drying wire.

53. (currently amended) The air impingement method of claim 49, wherein the step of subjecting the web to air impingement comprises blowing air through at least one hood is used for air impingement, which hood is placed on top of a drying cylinder, a suction roll, an air impingement roll or a cooling cylinder and by means of which, in a machine direction, a blowing with hot air is first blown against the web from a hot blowing part and after that a blowing with cold air from a cold blowing part, said drying cylinder, suction roll, air impingement roll or cooling cylinder being disposed in connection with ~~[[the]]~~ a last drying cylinder, suction roll, air impingement roll or cooling cylinder of the dryer unit and divided into two sections by a partition wall.

54. (previously presented) The air impingement method of claim 49, wherein two separate hoods are used for air impingement, said hoods being placed on top of two successive drying cylinders, suction rolls, air impingement rolls or cooling cylinders disposed as the last cylinders/rolls in the dryer unit, hot air being blown through the hood which is placed first in a machine direction and which is a hot blowing part blowing hot air and located in connection with the second last drying cylinder, suction roll, air impingement roll or cooling cylinder, and cold air being blown through the hood which is placed further down in a machine direction and which is a cold blowing part blowing cold air and located in connection with the last drying cylinder, suction roll, air impingement roll or cooling cylinder.

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55. (previously presented) The air impingement method of claim 49, wherein for air impingement are used a hood arranged on top of and in connection with the last drying cylinder, suction roll, air impingement roll or cooling cylinder of the dryer unit, said hood being a hot blowing part blowing hot air against the web, and a blow box or an airborne drying unit which extends across the width of the web and which is a cold blowing part blowing cold air against the web.

56. (previously presented) The air impingement method of claim 49, wherein the web is further cooled during air impingement or after it by a cooling cylinder.

57. (currently amended) The air impingement method of claim 49 wherein the step of subjecting the web to at least one cold air blowing comprises subjecting the web to a blowing in which the temperature of air in the cold blowing part is below 50° C.

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58. (currently amended) A paper or board making machine comprising:
a former unit for a paper or board web;
a press unit;
a source of hot blowing air;
a source of cold blowing air; and
at least one dryer unit having a web running therethrough, and having at least one air impingement device first section which extends substantially across the entire width of the web running in the vicinity of the web air impingement device, wherein a first contact-free web treatment zone being is defined where the web is subject to the air blowing from the air impingement device first section, and the at least one dryer unit further having at least one air impingement device second section positioned after the first section in the machine direction, the second section extending substantially across the entire width of the web running in the vicinity of the air impingement device second section, a second contact-free web treatment zone being defined where the web is subject to the air blowing from the air impingement device second section, wherein the at least one air impingement device first section is connected to the source of hot blowing air, and the at least one air impingement device second section is connected to the source of cold blowing air, and for the purpose of compensating for the curl of the web, the paper or board making machine being thus configured to apply to the web following one after the other, at least one hot blowing and at least one cold blowing with air.

59. (previously presented) The paper or board making machine of claim 58, wherein moisture condenses and/or is absorbed into the web in cold blowing, and the curl behaviour of the web changes to the range of structural, reversible, curl behaviour.

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60. (previously presented) The paper or board making machine of claim 58 wherein the air impingement in the air treatment zones of the web is applied to a free surface of the web.

61. (previously presented) The paper or board making machine of claim 58, wherein the air impingement in the air treatment zones of the web is applied to the web through a drying wire located on the web.

62. (currently amended) The paper or board making machine of claim 58, wherein each air impingement arrangement device includes at least one hood which is placed on top of [[the]] a last drying cylinder, suction roll, air impingement roll or cooling cylinder of the dryer unit and divided by a partition wall, in which connection, in a machine direction, and the first section is divided from the second section by the partition wall.

63. (currently amended) The paper or board making machine of claim 58, wherein the air impingement arrangement device comprises two successive and separate hoods, the at least one air impingement device first section being defined by a first hood, and the at least one air impingement device second section being defined by a second hood.

64. (previously presented) The paper or board making machine of claim 58, wherein the first section comprises a hood which is placed first in a machine direction on top of a last drying cylinder, suction roll, air impingement roll or cooling cylinder of the dryer unit and which serves as a hot blowing part and blows hot air against the web; and wherein the second section comprises a blow box or an airborne drying unit which extends across the entire width of the web and which serves as a cold blowing part and blows cold air against the web.

65. (previously presented) The paper or board making machine of claim 58 further comprising a cooling cylinder which acts on the web in a machine direction during or after air impingement.

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66. (currently amended) The paper or board making machine of claim 58, wherein the temperature of air of the cold blowing [[part]] is below 50 °C.

67. (currently amended) A paper making machine having an air impingement arrangement for compensating for the curling tendency of a paper or board web which is being treated, the paper making machine comprising:

- a dryer unit having a first end roll, and a second end roll positioned upstream of the end roll;

- a web passing from the second end roll to the first end roll;

- a source of hot blowing air;

- a source of cold blowing air;

- a first hood portion which extends substantially across the entire width of the web running in the vicinity thereof and forms a contact-free first web treatment zone where the web passes over one of the end rolls, the first hood portion being connected to the source of hot blowing air for discharging hot air onto the first web treatment zone; and

- a second hood portion which extends substantially across the entire width of the web running in the vicinity thereof and forms a contact-free second web treatment zone where the web passes over one of the end rolls downstream of the first web treatment zone, the second hood portion being connected to the source of cold blowing are air for discharging cold air at a lower temperature than the hot air onto the second web treatment zone.

68. (previously presented) The paper making machine of claim 67 wherein the first web treatment zone and the second web treatment zone are both formed over portions of the first end roll, and the first hood portion and the second hood portion are part of a single bipartite hood which is divided by a partition wall.

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69. (previously presented) The paper making machine of claim 67 wherein the first web treatment zone is formed over portions of the second end roll, and the second web treatment zone is formed over portions of the first end roll.

70. (previously presented) The paper making machine of claim 67 wherein a drying wire is disposed over the web as it passes through the first web treatment zone and the second web treatment zone.

71. (previously presented) The paper making machine of claim 67 further comprising a cooling cylinder downstream of the first end roll, over which the web travels after passing through the second web treatment zone.

72. (currently amended) The paper making machine of claim 67, wherein the temperature of air at the second web treatment zone ~~of the cold blowing part~~ is below 50 °C.